Productivity Commission Submission – Science and Innovation

Economic, Social and Environmental Returns on Public Support for Science and Innovation in Australia.

The Baker Heart Research Institute welcomes the opportunity to contribute to the Productivity Commission research study on public support for science and innovation.

The Australian Government recently announced an additional $905 million for medical research in the 2006-07 Budget. This investment is extremely timely, recognising the importance of increasing Australia's capabilities in health and medical research and the profound effects a lack of growth in public spending would have on health care delivery and private investment in biotechnology and other health related areas.

With 0.3% of the world's population, Australia produces about 3% of the world's health R&D output[1]. Australian scientists have received five [2] Nobel prizes for Medicine or Physiology and both our clinical and public health research continues to deliver high impact publications (6.8% of Australia's health and medical research publications are in the top 5% of the world's most cited publications[3]). As stated in the Wills Review, Australia is widely recognised internationally for its strengths in health and medical research.[4]

The Baker Heart Research Institute is now in its 80th year and it is Australia's most distinguished cardiovascular research centre and one of the world's leading organisations investigating the causes and complications, treatment and prevention of heart, stroke and vascular disease.

Cardiovascular (heart, stroke and vascular) disease is Australia's leading health problem. At a direct cost of $7 billion a year, it makes up 11 per cent of Australia's total direct health care expenditure.

Cardiovascular research is funded by public agencies, (e.g. NHMRC has committed approx. 16% of its budget in 2006 to cardiovascular research) non profit organisations such as the Heart Foundation (19% of National Heart Foundation annual turnover) and by industry, largely through drug trials. Of these funding sources, the latter is directed towards wealth generation whereas the former addresses the public burden of the major cause of death and disability in the Australian community and the largest driver of costs to the PBS, of private health insurance (cardiac interventions) and the major future threat to longevity (cardiovascular disease associated with obesity and diabetes).

With the ageing population and the projected increases in costs as per the Intergenerational Report there has never been a more important time to invest in health and medical research and to minimise the impediments to innovation.

Health and Medical Research (HMR) delivers returns

Money spent on HMR is money invested in Australia's health and economic future and it generates returns.

Medical research has increased life expectancy.

The real purpose of health and medical research is in improving health and the performance of the health system. "While it is unlikely that research could reduce health care expenditure in the face of its expected upward trend, it will help stem the rise in costs and deliver better health value from the health dollar."[5]

According to Peter Doherty, (awarded Nobel Prize in Physiology or Medicine 1996) the expense of medical research is infinitely less than the cost of health care delivery, which is now consuming such a high proportion of national budgets in every advanced country.[6] As attention now moves from research on treatment and cure to prevention, the rewards to the community will increase.

Cardiovascular disease showed returns nearly 8 times annual investment in this area. [7]

The following are two case studies from the Baker illustrating returns from research:

1. ACE inhibitors used in the treatment of hypertension and heart failure have had a large Australian contribution to their development. Research with experimental models performed by Professor Mark Cooper and colleagues showed the potential of ACE inhibitors to protect the kidney, and more recently to reduce the development of diabetes by up to 30%. This subsequently was proven in large clinical trials around the world and has had a major impact on the development of national and international treatment guidelines. The overall effect of these agents is a more efficient health system with reduced morbidity and mortality, noting that diabetes remains an area of high cost and disability.[8]

2. Exercise programs have effects in the heart in common with beta blockers leading to a paradigm shift in the use of cardiac rehabilitation programs in Australia, a 50% reduction in heart failure mortality and inclusion of beta blocker treatment in heart failure treatment guidelines around the world. The research conducted at the Baker Heart Research Institute by Professors David Kaye, Murray Esler and Garry Jennings underpinned these developments.

Heart failure is both a common cause of death and of disability, particularly in the older population.

There are over 40,000 hospital admissions a year in Australia each year where heart failure is recorded as the principle diagnosis.[9]

Thus public funding for research has led to improved quality of life after heart failure and reduced mortality and hospital readmissions.

Support

Australians support health and medical research and recognise the economic and social benefits.

Australians understand that health and medical research delivers economic returns for Australia. As illustrated by the Research Australia public opinion polls[10], the majority of Australians strongly agree that:

- New discoveries and inventions create new medicines, devices and vaccines to produce and export (70%)
- Lack of funding means that Australian discoveries are often commercially developed by other countries (67%)
- Health and medical research creates jobs and new business through new discoveries and inventions (61%)

The Australian Government has recognised the importance of HMR. After the Wills Review in 1999, $614 million was invested over six years and in 2006, after the Grant Review, the Federal Government announced an additional $905 million over five years for Australian Health and Medical Research as a 'major investment in our future health'.[11] These increases have maintained Australia's level of HMR investment on par with the OECD average of 0.2% of GDP.

Health and Medical Research requires sustained and increased funding over time as there are long lead times in developing and maintaining technologies and an innovative and skilled workforce thus such increases in Government investment are vital. Without a long-term HMR investment strategy Australia is at risk of losing her competitive edge in the sector.

It is also crucial that such investment be administered efficiently to deliver innovation which translates to health and commercial outcomes for Australia.

Barriers to innovation:

To encourage further HMR innovation and capitalise on the increased funding we suggest that the following issues be addressed:

Workforce/ training

We are losing some of our best scientists and researchers to overseas and to counteract this we need to create an attractive and supportive research environment. Australian scientific salaries are not competitive in general with those overseas. For example a European Academic would earn comparatively less by a factor of 0.6 (depending on the exchange rate) in Australia than they would in Europe.

Just as important scientific salaries are not competitive with those in professional services and other industries. This is likely to translate to future workforce skills shortages as we lose scientists to better remunerated sectors.

University cut offs for science have remained static for many years compared to other courses which have become more competitive. Students are not attracted to science as a career option because of the low pay.

There are reasonable opportunities for PhD Scholarships (albeit $20 – 25K/ year) Early post doctoral scholarships (Career Development Awards) are better catered for now. However, there are major blocks as these people progress to career scientists and the Fellowship stream which is a wastage of skills and effort.

The training phase is prolonged, especially for medical graduates who are a critical element to effective biomedical research. Typically, 6 year undergraduate course (or 3+3), then 3 years basic physician training before research training has even commenced and 4 years advanced training to obtain clinical credentials as mandated by the relevant College. This may be followed by 3 years PhD, then Post Doc 3 – 4 years. The latter is best done overseas to the benefit of both the individual and Australian research. A PhD stipend is typically 33% of the salary of a hospital registrar. However, local funding is limited at this stage and patience has often waned. PhD training could be combined with medical training as has been done overseas to reduce the time taken and make this option more attractive, if Colleges and Universities were more flexible.

NHMRC grant application process

In response to the Wills and Grant Reviews there have been a number of structural changes to and within the NHMRC including the appointment of a CEO and most recently NHMRC has been made a separate statutory body outside the Department of Health and Ageing.
This latter development has clarified lines of communication both internally and to the Minister of Health.

In addition NHMRC has over the past five years been refining its granting mechanism to deliver larger, longer duration grants.

With the recent appointment of Warwick Anderson as the CEO of NHMRC it is likely that NHMRC granting mechanisms will undergo further changes.

We wish to support further refinement of the NHMRC grant system to deliver funds to the brightest and best medical researchers and to meet areas of strategic need in a more efficient manner. The Australian Research Council is generally not accessible to independent medical research institutes.

Currently researchers spend up to three months per year writing multiple grant applications to NHMRC and also to other national and international bodies for various aspects of their research effort including salary, direct research costs and commercial development.

We strongly support integration of these separate funding schemes and longer duration grants to allow scientists to focus their efforts on innovation rather than administration.

There are also potential efficiencies to be made through integration of the Australian research effort beyond NHMRC through co-ordination of research in specific health areas. The potential of international agreements and cooperation is increasing now that research is more globalised.

In this regard we support a role for NHMRC in facilitating communication between relevant funding bodies, patient groups and other key stakeholders to foster a strategic disease-based approach to innovation. This will facilitate the research effort and promote economies of scale in terms of the sharing of knowledge/ technology/ equipment and expertise.

Infrastructure

Only in the last two or three years has direct infrastructure support been available through the NHMRC IRIISS (Independent Research Institute Infrastructure Support Scheme) program. However, almost half of all Baker competitive research grant funding is from non NHMRC sources and does not attract Federal infrastructure funding. The costs associated with supporting research equipment and materials to conduct research are increasing. The Victorian Government has provided infrastructure grants on an ad hoc basis. This means that for Independent Medical Research Institutes fundraising has to go towards funding the infrastructure gap rather than initiating innovation and seeding new initiatives.

The Australian Government announced in the 2004-05 Budget – the National Collaborative Research Infrastructure Strategy (NCRIS) as part of *Backing Australia's Ability – Building our Future through Science and Innovation.* The $542 million NCRIS funding recognised that infrastructure is a key determinant on the success of research and innovation and that in order to ensure Australia

maximises the return on its investment in research, researchers must be able to access infrastructure that keeps pace with international capabilities and new technology. We look forward to hearing more from the Minister for Education, Science and Training about the implementation of NCRIS. This is a significant investment which will support collaboration and help to drive research outcomes.

Commercialisation

Competitive Grant System Does Not Support Innovation and Commercialisation

Grant System does not support Proof-of-Concept Studies: The main competitive funding body for Australian Medical Research, the NHMRC, is structured so that the merit criteria by which grants are assessed is focussed on the strength and innovativeness of the research proposal, the track record of the research group and ensures that the research is exploratory in nature. Traditionally, once a technology has moved past proof-of-concept, it no longer satisfies the NHMRC's merit criteria, however technologies at this stage are generally too early to attract commercial funding from Venture Capitalists or industry partners.

Two examples of Australian discoveries that were not commercialised are:

- GCSF (hormone that stimulates blood cell growth used in treatment of cancer patients) discovered by Metcalf at the Walter and Eliza Hall Institute and subsequently commercialised by AMGEN in the US.
- A form of mass spectroscopy discovered at St Vincent's Hospital Department of Biochemistry was never commercialised in Australia.

The Federal Government recognised this funding gap and developed the Pre-Seed Venture Funds, which were set-up with $20million to invest into early stage technologies. Unfortunately, the Pre-seed Funds were prohibited from investing into technologies emanating from Medical Research Institutes and therefore the problem remains and is growing as scientists become more commercially aware.

The new NHMRC Development Grant initiative, directly addresses this issue, however the grants are too small and too few in number to genuinely address the problem. An expansion of this initiative, to enable promising technologies to move from the proof-of-concept stage through until they are attractive to the Venture Capitalists and the Commercial Community, would support Innovation in the Australian Research Community.
The Israeli Government has approximately fifteen support schemes at different points of the innovation cycle and this has proven to be very effective. One example of this is the Technology Incubator Programme (T.I.P.).

Established by the Israeli Government in 1991 – the T.I.P. supports very early stage entrepreneurial projects through grants and administrative supports. Each incubator is an independent non-profit making legal entity which can run 10-15

R&D projects simultaneously. 100% finance is provided by the Government for administration of the incubator and 85% funding is provided for 2 years to each company/project. In 1999, 26 incubators, with almost 230 projects and 900 high-tech professionals, were supported through a budget of US $30 million. Typically, companies remain in the incubator for 2 years and after that they are expected to survive on other State supports of outside investment. 592 projects have left the incubators since the programme began in 1991. Approximately 50% of those are still operational and almost 40% have attracted further investment.[12]

Publish of Perish – The Current System Does not recognise or Reward Innovative Scientists who commercialise IP: When an innovative breakthrough is made by a scientist, it is crucial that they publish this work as soon as possible, as their success in the next round of grants or their likelihood of a promotion, is directly tied to their publication output. However, once an idea has been published it is no longer novel and cannot be patent protected, therefore it loses its commercial value and will no longer attract commercial funding to drive forward the innovation.

The desire to publish, forces the Medical Research Institutes to file patents early, before the research is published. This means that the escalating patent costs come early, well before the technology has progressed towards a commercial outcome. This in turn means that Medical Research Institutes are faced with escalating patent costs, but with no funding with which the research can be progressed or the patent supported. Therefore, it is common for technologies at this stage to be sub-optimally assigned to third parties or for the patents to lapse.

These issues could be overcome by making patent expenditure an eligible expense in normal grants or by expanding the development grant system to accommodate intellectual property protection as well as proof-of-principal research.

Professionally recognising and rewarding commercially successful scientists could overcome these problems. In order to attain a patent for research findings, the work must be truly novel and inventive and therefore, the filing of a patent should be weighted heavily in comparison to a publication – i.e. A granted patent should be weighted equally with a publication in a high-impact journal. This would ensure that a scientist does not have to choose the commercial path at the expense of his or her own career trajectory. Furthermore, Universities and Medical Research Institutes should recognise research income derived from commercial activities equally with that of grant income. Thus, a scientists attracting $1million of commercial research into a laboratory should enjoy the same recognition and privileges enjoyed by a scientist that attracts and equal sum through competitive grants.

As stated in the Wills Review, “the outlook of health and medical research lies not only in greater government investment, but also in establishing the links

between public funding, research and the commercialisation of findings through industry."[13]

Conclusions

The Australian Government has made a significant investment in health and medical research since 1999.To effectively capitalise on this investment through innovation, improvements are required in workforce/ training, infrastructure, NHMRC grant application process and commercialisation. Appropriate refinements in these areas will work to more efficiently deliver health and economic returns to the Australian community.

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[1] The Investment Review of Health and Medical Research 2004, 13 (Grant Review)
[2] Florey, Eccles, Burnett, Doherty, Marshall + Warren
[3] Butler L et al NHMRC – supported research: the impact of journal publication output. In. Canberra; 2003
[4] The Virtuous Cycle Working together for health and medical research Health and Medical Research Strategic Review 1999 p 1 (Wills Review)
[5] The Virtuous Cycle Working together for health and medical research Health and Medical Research Strategic Review 1999 p 85 (Wills Review)
[6] Doherty, Peter 2005 The beginner's guide to winning the Nobel prize Melbourne University Press p 50
[7] Exceptional Returns -The Value of Investing in Health R&D in Australia, Access Economics Report 2003, 72)
[8]Brenner BM et al for the RENAAL Study Investigators. Effects of losartan on renal and cardiovascular outcomes and mortality in patients with type 2 diabetes and nephropathy: Results of the *Reduction of Endpoints in NIDDM with the Angiotensin II Antagonist Losartan* (RENAAL) study. N Engl J Med 345, 861-869, 2001 and Jandeleit-Dahm, K et al Why blockade of the renin–angiotensin system reduces the incidence of new-onset diabetes. J Hypertens 23:463-473, 2005
[9] AIHW 2004.Heart, stroke and vascular diseases - Australian facts 2004. AIHW Cat. No CVD 27. Canberra: AIHW and National Heart Foundation of Australia (Cardiovascular Disease Series No.22)
[10] Research Australia's Health and Medical Research Public Opinion Poll 2005, p 11 (Crosby Textor)
[11] Minister Abbott Media Release "Funding Research for Future Health" 9 May 2006.
[12] Source : Irish Council for Science, Technology & Innovation website
[13] The Virtuous Cycle Working together for health and medical research Health and Medical Research Strategic Review 1999 p ii (Wills Review)